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| 09/940,825 | 08/27/2001 | Ramakrishna Kakarala | 10010667-1 | 6666 |

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AGILENT TECHNOLOGIES, INC.
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EXAMINER

HERNANDEZ, NELSON D

ART UNIT PAPER NUMBER

2612

DATE MAILED: 11/17/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

| | | | |
|------------------------------|--|--|--|
| Office Action Summary | Application No. 09/940,825 | Applicant(s) KAKARALA ET AL. | |
| | Examiner Nelson D. Hernandez | Art Unit 2612 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 12 September 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-33 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,2,6-8,15,19-21,23,29 and 32 is/are rejected.
- 7) ☒ Claim(s) 3-5,9-14,16-18,22,24-28,30,31 and 33 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 27 August 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. Please note that the examiner of record has changed. All future correspondence should be directed to Nelson D. Hernandez whose information is provided at the end of this Office Action.

Response to Arguments

2. Applicant's arguments, see page 4, line 2 – page 7, line 9, filed September 12, 2005, with respect to the rejection of claim 1 under 35 USC § 102(e) have been fully considered and are persuasive. Therefore, the rejection has been withdrawn.

However, upon further consideration, a new ground(s) of rejection is made in view of newly prior art reference found.

3. Applicant's arguments, see page 3, line 24 – page 4, line 23, filed September 12, 2005, with respect to the rejection(s) of claim(s) 6, 7, 15, 20, 23 and 29 under 35 USC § 102(e) have been fully considered but they are not persuasive.

Applicants contend that "the symbol $C(i, j)$ is, in every instance, simply a one-dimensional parameter that identifies only a single numerical value oriented in a single direction. In particular, $C(i, j)$ is a signed integer value, and the sign of the integer value (positive or negative) identifies the directional orientation (horizontal or vertical). Wang column 7, lines 45-52. Thus, although different instances of $C(i, j)$ can specify different directional orientations (a horizontal/row orientation or a vertical/column orientation), nevertheless, any single instance of $C(i, j)$ can only specify one directional orientation.

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The i and j indices merely identify the pixel location to which the one-dimensional parameter $C(i, j)$ corresponds. It should also be noted that the aforementioned integer value and its sign, as specified by $C(i, j)$ for any given pixel location, will depend upon the interpolation direction selected for that pixel location”.

Examiner disagrees, Wang teaches that the continuity measure $C(i, j)$ is determined for each location (column and row) in the image, wherein said measure has a row and column component (i, j) to identify said location of said continuity measure. The claim recites “said first and second degrees of change each having a row component and a column component”, by teaching that the continuity measure $C(i, j)$, is determined for a specific location (i, j), Wang discloses the continuity measure having a row and column component. Therefore, the rejections of claims 6 and 19 are maintained.

Claim Objections

4. **Claim 24** is objected to because of the following informalities: In line 3 the word “sad” must be written as “said”. Appropriate correction is required.

Claim Rejections - 35 USC § 102

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. Claim 1 is rejected under 35 U.S.C. 102(e) as being anticipated by Chen, US Patent 6,570,616 B1.

Regarding claim 1, Chan discloses a method for determining whether a pixel lies on an edge of a digital image, said method comprising: determining, for said pixel, a first edge-orientation of a first color and a second edge-orientation of a second color said first and second edge-orientations each having a row component and a column component (Col. 8, line 64 – col. 12; line 32); and providing respective interpolation votes (Chen discloses a set of conditions used to determine the interpolation orientation, wherein the vertical and horizontal edge orientations are established by determining the edge orientations based on said conditions, see col. 10, line 34 – col. 11, line 65) associated with said first edge-orientation and said second edge-orientation based on said respective row components and said respective column components to determine a selected interpolation orientation (the edge detection is based on the positions of the pixels surrounding a target pixel, said positions are determined based on the column and row components for each surrounding pixels), said respective interpolation votes being either a first interpolation orientation or a second interpolation orientation (See figs. 7, 8, 11), said selected interpolation orientation being based on the number of said interpolation votes (Conditions met for each edge detection) for said first interpolation orientation and said second interpolation orientation (Col. 8, line 64 – col. 12; line 32).

6. Claims 6, 7, 15, 19, 20, 23 and 29 are rejected under 35 U.S.C. 102(e) as being anticipated by Wang, US Patent 6,781,626.

Regarding claim 6, Wang discloses a method for demosaicing a digital image represented as values at pixel locations, said method comprising: receiving a set of first color values (red or blue also referred to as chrominance) and a set of said second color values (green also referred to as luminance; col. 7, lines 25-34; determining for a given one of said first color values associated with a given one of said pixel locations a first degree of change (an intensity gradient is calculated for the pixels adjacent to the target pixel; col. 8, lines 34-54) using said set of first color values and a second degree of change using said set of second color values (a continuity measure $C(i, j)$ is determined at each pixel location for green, red and blue values for determining the degree of continuity in the horizontal and vertical directions; col. 7, line 45 – col. 10, line 47), said first and second degrees of change each having a row component and a column component; comparing said row component to said column component for both said first and second degrees of change to determine a selected interpolation orientation (the intensity gradient is compared to the continuity measure to determine the interpolation direction; col. 8, lines 34-54) (Col. 7, line 18 – col. 11, line 27).

Regarding claim 7, Wang discloses interpolating the missing second color value associated with the given pixel location using the selected interpolation orientation (Fig. 7, steps 908-926; col. 7, lines 27-60).

Regarding claim 15, limitations can be found in claim 6.

Regarding claim 19, claim 19 is an apparatus for the method in claim 6. Wang teaches the apparatus (Fig. 1) for performing the method as in claim 6. Grounds for rejecting claim 6 apply here.

Regarding claim 20, limitations can be found in claims 6 and 19.

Regarding claim 23, Wang discloses that the processor is further adapted for receive a set of third color values, said sets of first, second and third color values (red or blue values) each being associated with a different color, said processor being capable of determining a third degree of change associated with said third color values (the processing for the third set of color values is performed the same way as with the first and second sets). Grounds for rejecting claims 6 and 19 apply here.

Regarding claim 29, limitations can be found in claims 6 and 19.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. **Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chen, US Patent 6,570,616 B1 in view of Shinohara, "Color Image Analysis in a vector Field".**

Regarding claim 2, Cheng fails to teach that the first and second edge-orientations are first and second gradients, respectively, said first and second gradients forming a Jacobian of said pixel.

However, Shinohara teaches using the Jacobian matrix in edge detection for determining vector gradient magnitude (see pages 23 and 24, Definition of a vector

field). Shinohara also teaches that by using the Jacobian matrix, edges are more accurate and finer than the edges obtained by other methods. Using Jacobian matrix is advantageous in the system of Chen for creating defined edges in which interpolation orientation can be determined. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Chen by having a first and second gradients forming a Jacobian of the pixel for the purpose of creating accurate edge orientation.

9. Claims 8 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang, US Patent 6,781,626 in view of Koshiba, US Patent 6,933,970 B2.

Regarding claim 8, Wang fails to teach interpolating said missing second color value by applying a linear prediction function that uses said first color values and said second color values.

However, using a linear prediction function that uses first color values and second color values for interpolating a missing second color value is well known in the art as taught in Koshiba. Koshiba teaches an interpolation method, wherein the target pixel (blue or red) is calculated by performing a interpolation to the adjacent pixels of the same color and subtracting an average of a different color (green), which is in the surroundings of said target pixel (Col. 16, lines 13-67). This is advantageous to reduce noise present in the image signals. Therefore, taking the combined teaching of Wang in view of Koshiba as a whole, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Wang by interpolating said missing second color value by applying a linear prediction function that uses said first color

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values and said second color values with the motivation of performing noise reduction to the image signals as suggested by Koshiha (Col. 15, line 32 – col. 17, line 44).

Regarding claim 21, limitations can be found in claim 8.

10. **Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wang, US Patent 6,781,626 in view of Eiho, US Patent 6,924,839 B2.**

Regarding claim 32, Wang fails to teach determining a Laplacian of a select color value within either said set of first color values or said set of second color values and add said Laplacian multiplied by an adjustable parameter to said select color value.

However, determining a Laplacian of a select color value within either said set of first color values or said set of second color values and add said Laplacian multiplied by an adjustable parameter to said select color value is well known in the art as taught in Eiho, wherein the Laplacian is calculated for a target pixel and said Laplacian is multiplied by a coefficient for adjusting the amount of sharpening in the image and subtracted from the target pixel (Col. 8, line 65 – col. 9, line 29) in order perform sharpening to the image data without causing emphasized noise and occurrences of an overshoot and undershoot. It is noted in Eiho that the Laplacian being multiplied by the coefficient is subtracted and not added to the target pixel, however the coefficient may be a negative value, so the Laplacian would be added to the target pixel, this would change the equation into a blurring or fading function, which would help to minimize sudden changes in the image signal (i.e. noise and defective pixels).

Therefore, taking the combined teaching of Wang in view of Eiho as a whole, it would have been obvious to one of ordinary skill in the art at the time the invention was

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made to modify Wang by determining a Laplacian of a select color value within either said set of first color values or said set of second color values and add said Laplacian multiplied by an adjustable parameter to said select color value. The motivation to do so would have been to minimize sudden changes in the image signal (i.e. noise and defective pixels).

Allowable Subject Matter

11. **Claims 3-5, 9-14, 16-18, 22, 24-28, 30, 31 and 33** are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

12. The following is a statement of reasons for the indication of allowable subject matter:

Regarding claim 3, the main reason for indication of allowable subject matter is because the prior art fails to teach or reasonably suggest that the first interpolation orientation is a horizontal interpolation and said second interpolation orientation is a vertical interpolation, and wherein said step of providing further comprises: setting a first one of said interpolation votes associated with said first gradient, said first interpolation vote being set as said horizontal interpolation when the absolute value of a row component of said first gradient is lower than the absolute value of .alpha. column component of said first gradient, said first interpolation vote being set as said vertical interpolation when the absolute value of said column component of said first gradient is

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lower than the absolute value of said row component of said first gradient; setting a second one of said interpolation votes associated with said second gradient, said second interpolation vote being set as said horizontal interpolation when the absolute value of α row component of said second gradient is lower than the absolute value of a column component of said second gradient, said second interpolation vote being set as said vertical interpolation when the absolute value of said column component of said second gradient is lower than the absolute value of said row component of said second gradient; and selecting either said horizontal interpolation, said vertical interpolation or a combination of said vertical interpolation and said horizontal interpolation for said selected interpolation orientation based on said steps of setting in conjunction with limitations in claims 1 and 2.

Regarding claim 9, the main reason for indication of allowable subject matter is because the prior art fails to teach or reasonably suggest that the step of interpolating further comprises: determining a number of said first and second color values that are below a low-light threshold value; and turning off said linear prediction function when said number exceeds an additional threshold value in conjunction with limitations in claims 6-8.

Regarding claim 10, the main reason for indication of allowable subject matter is because the prior art fails to teach or reasonably suggest determining a difference value by subtracting said interpolated missing second color value from said given first color value; and interpolating a missing first color value using at least said difference value,

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said missing first color value being associated with one of said pixel locations that did not produce said first color value in conjunction with limitations in claims 6 and 7.

Regarding claim 11, the main reason for indication of allowable subject matter is because the prior art fails to teach or reasonably suggest that the first and second degrees of change are first and second gradients, respectively, said first and second gradients forming a Jacobian of said given first color value, and wherein said step of comparing further comprises: supplying, by each of said first and second gradients, a respective interpolation vote, said interpolation vote being either a first interpolation orientation or a second interpolation orientation, said selected interpolation orientation being based on the number of said interpolation votes for said first interpolation orientation and said second interpolation orientation in conjunction with limitations in claim 6.

Regarding claim 16, the main reason for indication of allowable subject matter is because the prior art fails to teach or reasonably suggest determining a first mean luminance value of α . first group of said luminance color values and a second mean luminance value of α . second group of said luminance color values; determining a difference percentage between said first mean luminance value and said second mean luminance value; and increasing said luminance color values of said first group by said difference percentage when said first mean luminance value is lower than said second mean luminance value in conjunction with limitations in claims 6 and 15.

Regarding claim 17, the main reason for indication of allowable subject matter is because the prior art fails to teach or reasonably suggest determining a Jacobian of a

given one of said luminance color values from said set of luminance color values;
determining a first sum of the absolute values of the values within said Jacobian; and if
said first sum is less than a predefined threshold: multiplying said given luminance color
value by four, adding said luminance color values of four diagonally adjacent pixel
locations to obtain a second sum, and dividing said second sum by eight in conjunction
with limitations in claims 6 and 15.

Regarding claim 18, the main reason for indication of allowable subject matter is
because the prior art fails to teach or reasonably suggest determining a Jacobian of
said given first color value; determining a first sum of the absolute values of the values
within said Jacobian; and if said first sum is less than a predefined threshold: multiplying
said given first color value by eight, adding said first color values of eight nearest pixel
locations to obtain a second sum, and dividing said second sum by sixteen in
conjunction with limitations in claim 6.

Regarding claim 22, the main reason for indication of allowable subject matter is
because the prior art fails to teach or reasonably suggest that the processor is further
adapted to determine a number of said first and second color values that are below a
low-light threshold value, said processor being further adapted to turn off said linear
prediction function when said number exceeds an additional threshold value in
conjunction with limitations in claims 19-21.

Regarding claim 24, the main reason for indication of allowable subject matter is
because the prior art fails to teach or reasonably suggest that the processor is further
adapted to receive a set of third color values, said sets of first, second and third color

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values each being associated with a different color, said processor further being capable of determining a third degree of change associated with said third color values in conjunction with limitations in claims 19, 20 and 23.

Regarding claim 25, the main reason for indication of allowable subject matter is because the prior art fails to teach or reasonably suggest that the first, second and third degrees of change are first, second and third gradients, respectively, said first, second and third gradients forming a Jacobian of said given first color value, each of said first, second and third gradients supplying a respective interpolation vote, said interpolation vote being either a first interpolation orientation or a second interpolation orientation, said selected interpolation orientation being based on the number of said interpolation votes for said first interpolation orientation and said second interpolation orientation in conjunction with limitations in claims 19, 20 and 23.

Regarding claim 30, the main reason for indication of allowable subject matter is because the prior art fails to teach or reasonably suggest that the processor is further adapted to determine a first mean luminance value of α . first group of said luminance color values and a second mean luminance value of α . second group of said luminance color values, said processor further being adapted to determine a difference percentage between said first mean luminance value and said second mean luminance value and increase said luminance color values of said first group by said difference percentage when said first mean luminance value is lower than said second mean luminance value in conjunction with limitations in claims 19 and 29.

Regarding claim 31, the main reason for indication of allowable subject matter is because the prior art fails to teach or reasonably suggest that the processor is further adapted to determine a Jacobian of a given one of said luminance color values from said set of luminance color values and determine a first sum of the absolute values of the values within said Jacobian, said processor being further adapted to multiply said given luminance color value by four, add said luminance color values of four diagonally adjacent pixel locations to obtain a second sum and divide said second sum by eight when said first sum is less than a predefined threshold in conjunction with limitations in claims 19 and 29.

Regarding claim 33, the main reason for indication of allowable subject matter is because the prior art fails to teach or reasonably suggest that the processor is further adapted to determine a Jacobian of said given first color value and determine a first sum of the absolute values of the values within said Jacobian, said processor being further adapted to multiply said given first color value by eight, add said first color values of eight nearest pixel locations to obtain a second sum and divide said second sum by sixteen when said first sum is less than a predefined threshold in conjunction with limitations in claim 19.

Conclusion

13. Because new grounds for rejection are being applied to unamended claims 8, 21 and 32, this Office Action will be Non-Final.

Contact

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nelson D. Hernandez whose telephone number is (571) 272-7311. The examiner can normally be reached on 8:30 A.M. to 6:00 P.M..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ngoc Yen Vu can be reached on (571) 272-7320. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Nelson D. Hernandez
Examiner
Art Unit 2612

NDHH
November 13, 2005


NGOC-YEN VU
PRIMARY EXAMINER